

**National Research Conference on Climate Change†
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Climate Change and Water Governance in Delhi: Legends, Tales and Plans

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Government efforts to deal with scarcity mainly focus on increasing water supply, now going as far as the Tehri dam in Uttarakhand. Delhi's demands also override the needs of farmers in Harayana. Our Ecological footprint tramples on the other people's livelihoods and threatens fragile mountain landscapes. Yet perversely, while we draw upon distant sources, we're busy destroying our biggest local resource, the river Yamuna and her flood plain, which recharges groundwater for all of East Delhi. (Baviskar, 2010)

Migration and floating populations



Decrease
preference
for farming in
the coming
generations
(Bardhan,
2009)

Driven by drought, farmers wait at the Jhansi station to take a train to Delhi and make a living there. Photo: A M Faruqui

Source: <http://beta.thehindu.com/news/national/article15349.ece>

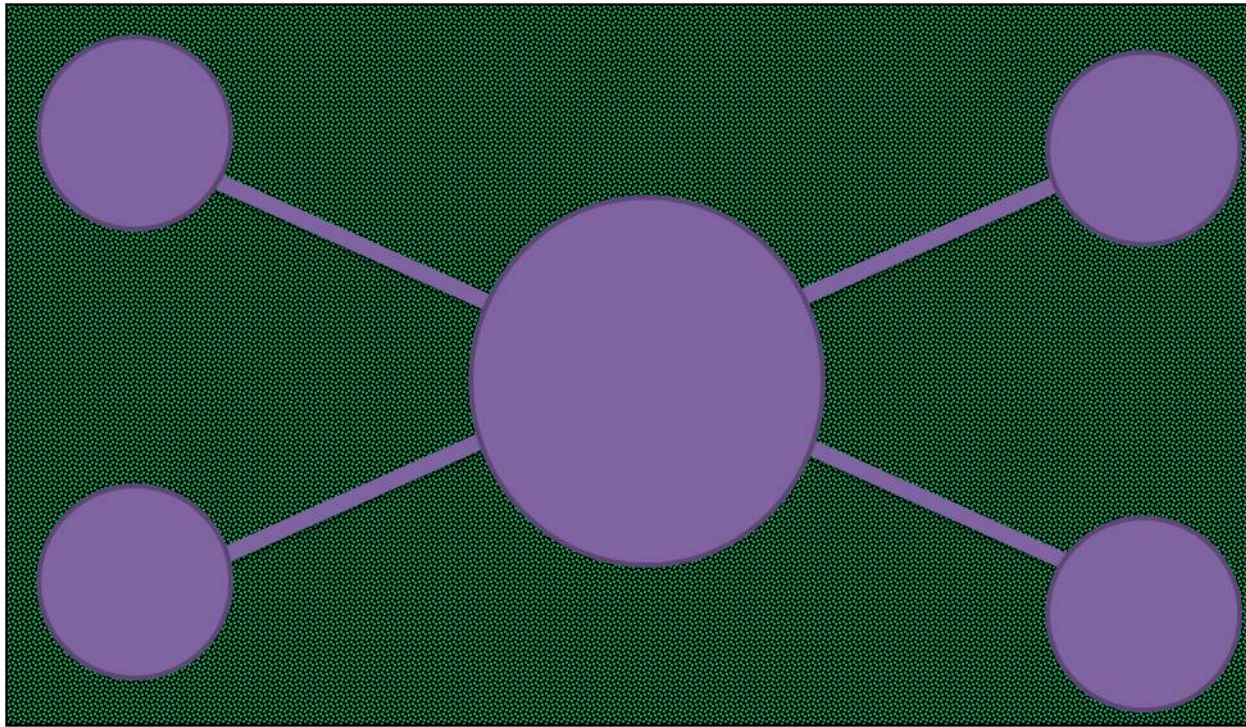
The urban sprawl

A view from above: Satellite image of Delhi



Source: Google maps, as on Feb 26, 2010

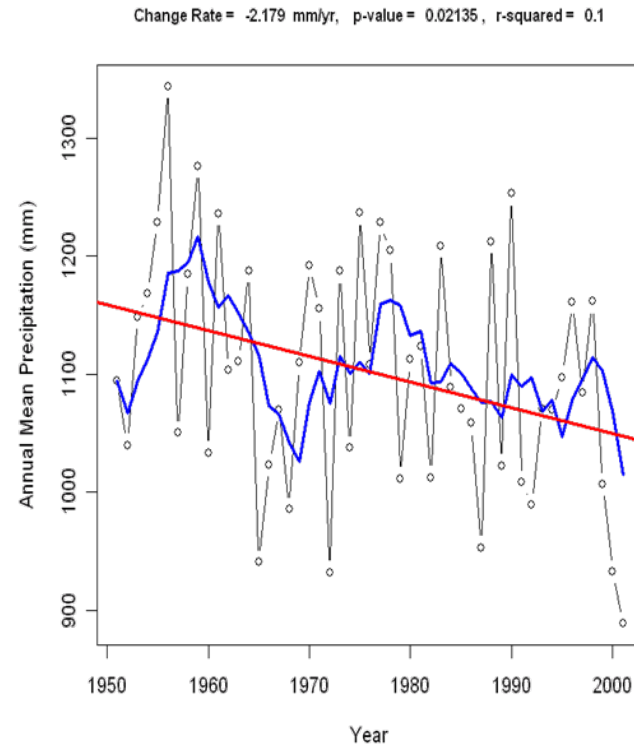
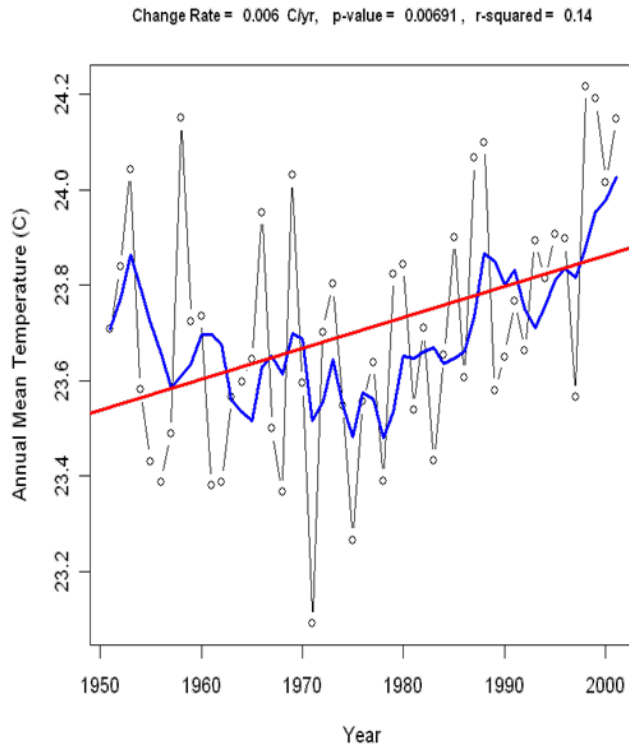
Future growth of urban agglomerations



The next twenty years of global demographic transformation is projected to witness a growth in the world's urban population to 5 billion and by 2030, developing countries will have 80 percent of the world's urban population (UN-Habitat, 2006).

Historical trends

India

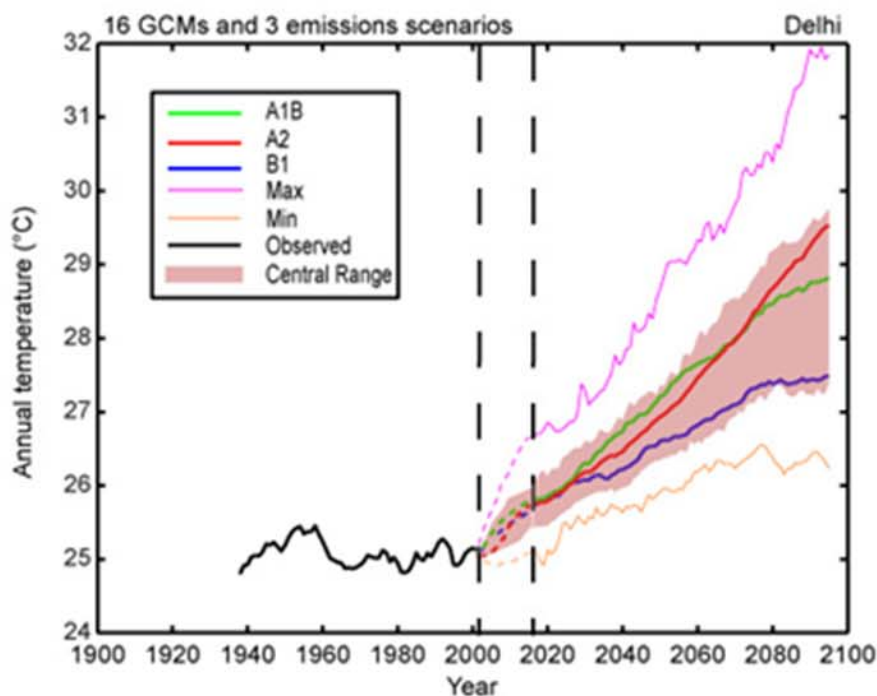


Data Source: Historical Global 50km: Climatic Research Unit and the Tyndall Centre. Also see Mitchell et. al.

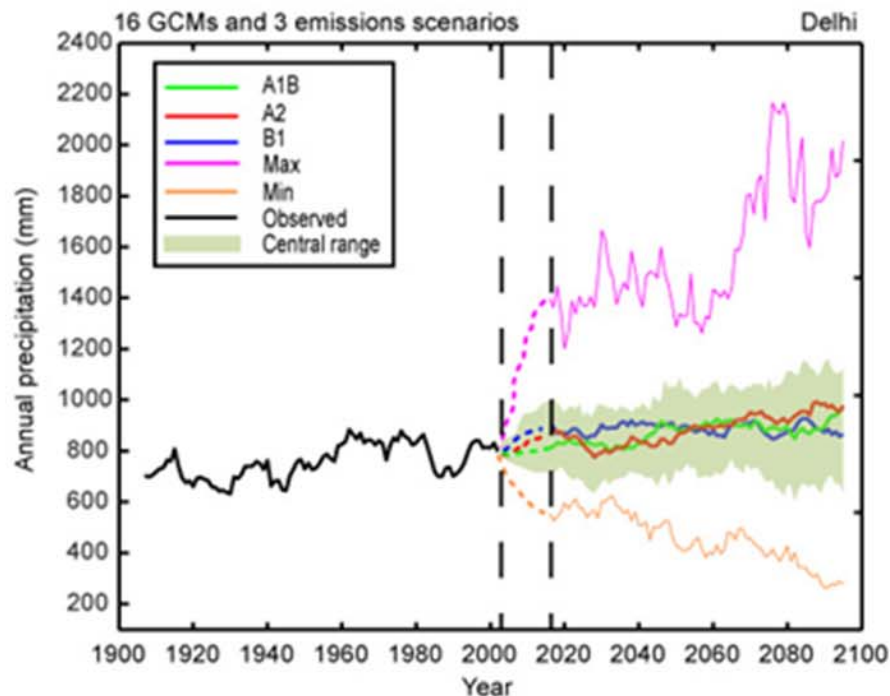
<http://cru.csi.cgiar.org/PDF/mitchelljones.pdf>

Key projections: Delhi

Projected Temperature Delhi



Projected Precipitation Delhi



Source: Center for Climate Systems Research (CCSR), Columbia University
as in Mehrotra et al., 2009

GCM summary: Delhi

	Japanese High Resolution GCM (20 km.)	IPCC GCMs		Country average values	
		Change (2091 - 2100 vs. 1981- 1990)	Change (2030 - 2049 vs. 1980-1999)	No. Models Projecting Same Change	
Mean Annual Precipitation:	4%	2%	12 out of 20	3%	
Mean Annual Temperature:	3 (°C)	2 (°C)	--	2 (°C)	
Heatwave Duration Index:	--	16 day(s)	8 out of 8	11 day(s)	

Source: World Climate Research Programme and Meteorological Research Institute and Japanese Metrological Agency

Also see <https://esg.llnl.gov:8443/> and http://www.mri-jma.go.jp/Dep/cl/cl1/publication/cl1_pc.html

reference coordinates 8 40' 0" N, 77 13' 0" E approx. Climate change and Water Governance in Delhi: Legends, Tales and Plans

Water stresses already exist; climate change is going to be an additional stress

More than 26 cubic miles of groundwater vanished from aquifers in the states of Haryana, Punjab, Rajasthan and the National Capital Territory of Delhi since 2002, says the study that has used NASA's satellite data. (Rodell et al, 2009)

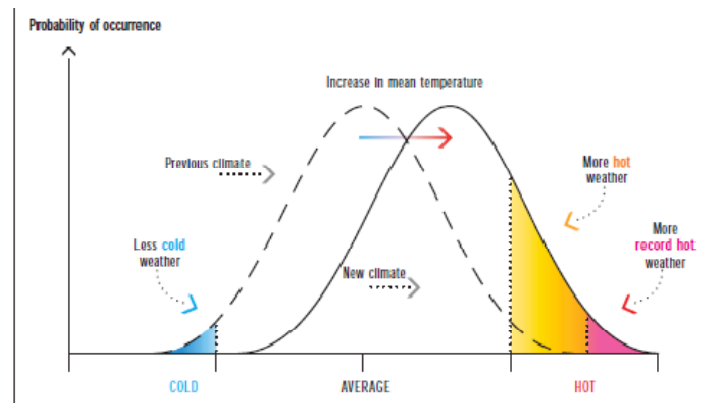
By 2025, the freshwater demand globally is projected to rise by 25% of more. Climate change is exacerbating the spatial and temporal variations in water availability. (Kundzewicz et al. 2007)

“Urban climate risk framework”

- Mehrotra et al (2009) propose three specific objectives
 - characterization of hazards associated with climate change at the city level
 - identification of the most vulnerable segments
 - assessment of the city’s ability to adapt to anticipated changes in climate.

Characterization of hazards

- Climate change induced variability in rains could increase climate extremes.
- Significant changes associated with climate events such as heat waves
- Summer 2009 Delhi example



Houghton et al, (2010) in World Health Organization, 2004

Climate extremes and linkages between water and health sector: Global studies

The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States (McGeehin and Mirabelli , 2001)

An evaluation of climate/mortality relationships in large U.S. cities and the possible impacts of a climate change (Kalkstein and Greene, 1997)

Adaptation measures for climate change and the urban heat island in Japan's built environment (Shimoda, 2003)

Urban sprawl and public health (Frumkin, 2002)

The 2003 heat wave in France: dangerous climate change here and now (Poumadere et al. 2005)

Workplace heat stress, health and productivity – an increasing challenge for low and middle-income countries during climate change (Kjellstrom et al. 2009)

Excess deaths even in countries like France due to heatstroke has been upto 60% more in 2003 when compared to baseline of the average of previous two years (WHO, 2004)

More frequent and intense winter rainfalls leading to riverine flooding and overwhelming of urban drainage systems (Wilby, 2007)

The vulnerable segments

- People worse affected could be the informal settlements, elderly and the physically unwell
- the severe shortage of drinking water in summers
- reduced upstream flows could worsen energy shortage

Population	Area	Population density	Slum population as a percentage of urban population
12.9 million	9,745 sq. km	1,324 people per sq. km	34.8 percent

Population statistics of Delhi Metropolitan

Source: National Census (2001) and UN Habitat (2008)

As per the projections of Census of India, the population of Delhi is expected to be over 24 million by 2021 and touch 28 million by 2026.

(Department of Urban Development, GoD).

Available at http://www.ccsindia.org/ccsindia/pdf/Ch02_City%20Demographic%20Profile.pdf

City's adaptive capacity

- The adaption strategies of the Delhi Jal Board include energy efficiency improvement programs in water supply, wastewater treatment, and methane recovery.

But these initiatives remain project based – and concerns to address the adaptive needs of the urban poor need further momentum especially in terms of ensuring equitable supply of water (Mehrotra et al, 2009; TERI, 2009)

- Lack of coordination between departments and among levels of government continue to inhibit a faster and efficient approach.
- Civil society has emerged especially in terms of promotion of practices like urban water harvesting

To cut the long story short...

...city planners cannot dismiss climate change as an urban legend, and adopting a 'no-regrets' approach by factoring climatic as well as non-climatic stresses becomes important.

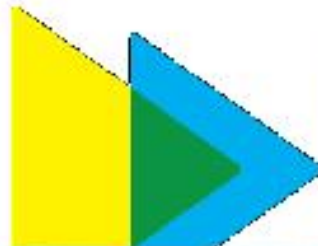
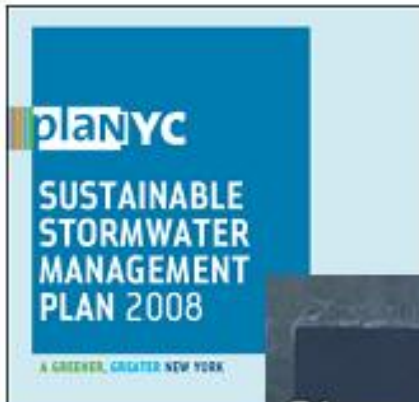
Adaptation in sectors like water and health becomes essential if city planners were to ensure well being of city-zens especially the urban vulnerable!

Rationale for systemic approach in city governance

- Cities have similar culture and lifestyles
- Similar set of built environment
- High population
- Economic activities
- Similar resource needs

The New York City Plan

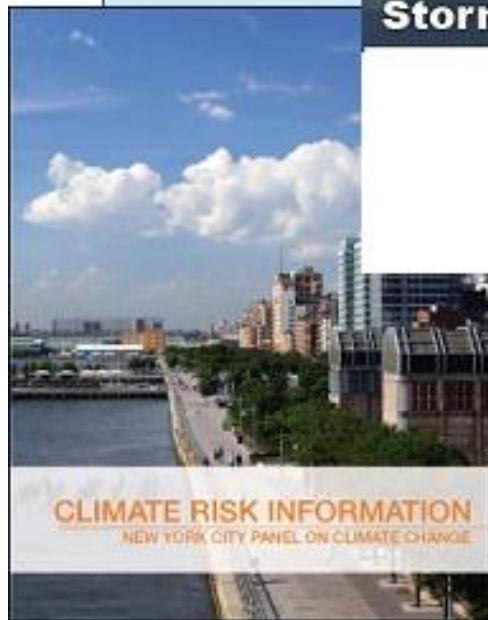
- **Aim:** develop and implement a long-term strategic vision for the City's future by working with city agencies, universities, scientists and experts and communities themselves and the.
- **Apparatus:** Bloomberg administration and NYC Office of Long Term Planning and Sustainability (OLTPS) ; New York City Panel on Climate Change (NAPCC)
- **Approach :** OLTPS in the Bloomberg administration launched the PlaNYC in June 2007. It provides a comprehensive sustainability plan for strategic management of the city's resources to meet growing demands of the population. The plan considers the demand on the resources of Water, Air, Transportation, Energy;and also considers risks due to Climate Change. Assessments were undertaken task-force led by top experts including city planners, scientists and communities themselves. Apart from undertaking retrofitting and new projects to improve and expand water supply. The city has adopted strategies that include establishment of water networks for increased vigilance to counter encroaches on the city's watersheds, ensuring quality of our water at its source by building new filtration plants and storm water runoff management.
- **Findings:** These have evolved rapidly into well monitored and networked community led management of water resources. Some examples include stormwater
- **Lessons:** mobilizing communities to network into self contained models of water governance. Involvement of the scientific and academic community for making detailed assessments for supporting policy and city planning decisions.



New York City Green Roof Buildings to Earn Tax Credit
 Recently passed bill offers eligible owners a one-year credit of up to \$100,000

S.W.I.M.

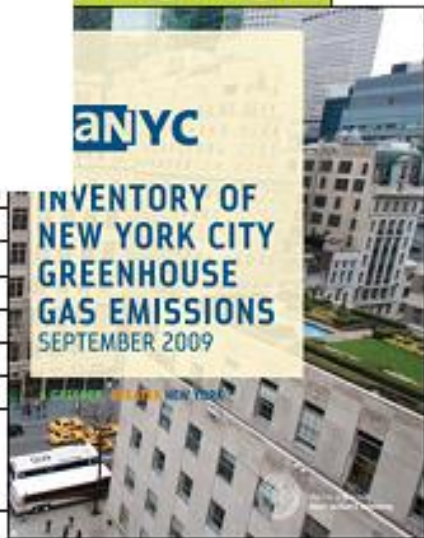
Storm Water Infrastructure Matters



S.W.I.M. Coalition March 2010 Public Meeting
 Thursday March 11, 2010, 3pm to 5pm

Location:
 Pratt Manhattan, room TBD
 144 W 14th St
 New York, NY 10011

- Build the Croton Filtration plant
- Launch a major new water conservation effort
- Maximize existing facilities
- Evaluate new water sources
- Complete Water Tunnel No. 3
- Complete Water Tunnel No. 3
- Complete a backup tunnel to Staten Island



Climate change and Water Governance in Delhi: Legends, Tales and Plans

The Mexico City Plan

- **Aim:** Set a road map for a proactive climate program by the Mexico City government to further city sustainability through a set of city level action plans.
- **Apparatus:** The Mexico City Climate Action Program (2008-2012) that furthers the framework of the Mexico City Environmental Agenda and the Green Plan.
- **Approach:** The plan includes public policies and sector specific actions. The water actions include two specific action plans –one focused on mitigation and Green House Gas reduction and the other is focused on adaptation. In the water sector, the former primarily deals with the reduction of GHG in both supply and demand side water related activities in the period 2008-2012.; the adaptation is outlines three forms of micro-basin management: Soil and water conservation projects, rural development and soil and water conservation on agricultural lands and urban ravines.
- **Lessons:** Lessons from the Mexico and New York model include a clear vision and action strategy for both supply and demand side of water management. Examples of supply side measures include GHG reductions (already planned for Delhi also) and demand side measures included initiatives like water

The New Delhi Plan

- **Aim:** To align city level actions with the National Action Plan on Climate Change (NAPCC) with city-level plan, the Climate Change Agenda for Delhi 2009-2012.
- **Apparatus:** Government of National Capital Territory of Delhi and some departments
- **Approach:** This policy document follows a 'sector specific' and 'target oriented' approach that aligns with the National Action Plan on Climate Change (NAPCC) and 'outlines' encouraging actions relevant to city governance in context of climate change. However the implementation agencies principally remain to be the line departments with little or no linkages with the civil society. Principal water specific implications are largely focused on addressing pollution of the Yamuna River, new infrastructure for waste water treatment, improving waste treatment for sewers and revitalizing of traditional water bodies. There is no mention of groundwater or drinking water or potable water.
- **Lessons (Lacunae):** *Consulta previa* with local communities seem to be absent and there is no mention of adaptive actions in considering the needs of a growing vulnerable population. There is no mention of potable or drinking water and the action plan seems to be focused on actions only in terms of water supply.

To cut the long story short...

...in the urban context, following a systemic approach to draw lessons from early adopters makes sense.

Water Sector in Delhi

Source of Water supply for Delhi Jal Board

S. No	Source	Quantity (MGD)
1	Yamuna	210
2	Ganga	100
3	Bhakra storage	240
	Sub total(surface water)	550
4	Ranney wells/ Tube wells	81
5	Total	631

Source: Economic survey of Delhi, 200-D2.

WDR(2010)- 50% of drinking water needs would be met from Groundwater

Provisioning of water: A review of efficacy of private and community initiatives

- Urban drinking water has the characteristics of a 'private good' as it is divisible and excludable in nature. However, for some, particularly the anti-privatisation and globalisation activists rally "water is a commons and a human right" (Bakker, 2007).
- Efforts in Common pool resource water management strategies have proven to be success under a few conditions: a small geographical area with well defined boundaries, low levels of mobility, a small community with a high degree of social capital and an overlap between residential and resource location (Bacdayan, 1974, Wade, 1998, Trawick, 2001 and Mosse, 2003).
- This conditions *often do not hold true* in the context of provisioning of water in urban areas and particularly in the case of a large metropolis, like Delhi. Other research points out the limitations of some of these collective action approaches in Water (Mosse, 1997, Cleaver, 2000, Mehta, 2001 and Potanski and Adams, 1998)

Provisioning of water: A review of efficacy of private and community initiatives

- Private provisioning of water could lead to various benefits (reduced tariffs, greater efficiency due to reduction in distribution and unaccounted losses, reduced infant mortality due to better quality water (also see Venkatachalam, 2007, p.7-8).
- However one of the problems in making the private sector work is to identify the rules of the game, which might take several years, especially in the case of, when they are being adopted for the first time and the trial and error method might be costly (Dumol, 2000).
- In Tiruppur, Tamil Nadu, India, citizens used to pay Rs. 1000/kilo litre in the informal private water market but, once the private sector operation started (under PPP); the price has drastically come down (Vyas, 2004) – But Caveat, This is an ‘industrial’ city so applicability to other cities in terms of the ‘replication’ possibilities have to be critically examined
- Apparelty Hubli-Dharward in Karnataka, privatization has started; empirical studies of this not yet begin; arena for future enquiry
- There are however several problems with the privatisation mode of water supply particularly and the experience from the Latin American experience (see Bakker, 2008) warns us that caution should be exercised. So the efforts towards privatisation in Delhi has to proceed cautiously and it is important that the rules of the game are properly worked out (Dumol, 2000).

Lessons from international experience

- There are inherent limitations of the community water supply models and the experience of Cochabamba, third largest city in Bolivia could provide some useful lessons for Delhi. Similar to Delhi, in Cochabamba, while wealthy consumers and business received municipally subsidized water, half the cities residents who lived in poor neighbourhoods relied on water delivered by tanker trucks, private wells or small scale community water systems. There were attempts to privatize the utility in 1999 with two large water companies being involved (Betchel of USA and United water of England). There were wide spread protests in 2000 with thousands taking to the streets. Eventually the privatization process was stopped and there were attempts to gain greater 'social control' over the water utility.
- An interesting experience, from which Delhi could learn is the experience of Porto Alegre in Brazil wherein alternative governance and business models are combined in the utility – DMAE. The utility is fully self financed with a progressive tariff structure (with cross subsidies) with nearly 100% coverage of water supply despite recent population growth. With a low non-payment ratio and high approval rating, DMAE is one of the best utilities in the developing countries. However, replication would not be easy and Chatterje (2004) rightly explains that political culture is important, and in the context of developing countries wherein exclusion has been an integral part of the 'modernization project' of the state, were only a sub-set of the citizens are identified as 'full citizens' with a full set of rights and entitlements. Climate change and Water Governance in Delhi: Legends, Tales and Plans

Delhi- already privatised? –some civil society concerns

- The water activists (under the umbrella of Citizen's Front for Water Democracy) contend that this is a
- “continuation of the trend of selling basic natural assets of the city to global corporations...For the last 15 years, the agency has been outsourcing work to private agencies in every area, from distribution to the laying of pipelines to sewage rehabilitation. But have we seen any positive result?” (Sardar Ahmad Naqvi, Convenor of Citizen's Front for Water Democracy)

Domestic water in Delhi: Problems in availability

- The total renewable resources have been estimated around 290 million m³/year. Isotopic Investigations to assess the natural recharge of NCT Delhi found that levels of recharge lower than 5% in most area, while in the urban centre, it was even lower at 3 %, Datta (1996).
- The inference of the data on per capita availability of water for the 1991-92 to 2006-07 period reveals that there has been a drastic decline in per capita water availability to its residents (www.indiastat.com)
- **Inequity in access: the sociologist Amita Baviskar observes – *In a water-scarce area like south Delhi where groundwater has been sucked dry, richer residents can buy tanker-loads of water to top up their supplies for watering gardens and washing cars, while poor slum-dwellers are forced to fight over a trickling tap. (Baviskar, 2006)***

Quality of the Domestic Water in Delhi

- A recent study reveals that there was a high correlation between the health of the Yamuna river and the citizens of the city (Peace Foundation, 2009)
- While there were 9,750 cases of Typhoid in 2000, it increased to 20,864 in 2008; while there were 0.13 million cases of diarrhoea, it increased to 0.24 million in 2007.
- An estimate (in 1998) based the study by the NGO, Public Affairs Centre found that “hidden costs of a whopping (more than) Rs 2,100 crore, incurred by the Capital's citizens to cope with the poor quality of service by investing in items like overhead tank, water pump, borewell, emergency lights, generators, water filter and Acqua Guard”

<http://www.expressindia.com/news/ie/daily/19980504/12450254.html>,
accessed on 15th February, 2010

Quality of the Domestic Water in Delhi

- An investigation of private strategies for coping (with unreliable public supply) found that the total annual cost of these strategies represented twice the annual public expenditure on water in Delhi (Zerah, 2000). Not only the poor, but also the middle class residents do not have a dependable source of clean water (Sengupta, S, 2006).

Inefficiencies and costs associated

- The Delhi Jal Board (DJB), the nodal agency for supply of water in the city is inefficient in various grounds. While the expenses of the DJB is 1,202.27 crores, the revenue is only 564.91 crore.
- The leakage and loss ratio of the utility is 47%. (Ghosh and Chandran, 2009) This translates into a total loss of over 200 million gallons per day (MGD) while the total supply is not more than 720 MGD.
- According to an estimate in 2000, the unreliability of water in Delhi costs annually Rs.3 billion which was double the annual municipal expenditure on water (Zerah, 2000). A survey by Public Affairs Centre in 2006 involving 14,165 respondents found the Delhi Jal Board was rated the worst in terms of user satisfaction (PAC, 2006).

The *Bhagirdari* approach: A model for local governance

- The governance measures being adopted in terms of the Bhagirdari approach of governance has not been of much use because there are inherent problems within the utility, DJB, which requires structural reform of the utility itself .
- So until such structural issues cannot be resolved, attempts in involving community (such as the Bhagirdari approach of the Delhi Government) would, we argue not be of much utility. It is rightly observed that community governance models are only meaningful when implemented in tandem with alternative service delivery approaches (TNI, 2005).

Conclusions

- Climate change is a reality. It cannot be dismissed as an 'urban legend' especially if city planners were to adopt a prudent approach for meeting the demands implied by a growing urban sprawl and vulnerable population. This becomes important considering strong linkages between the health and water sector.
- A systemic approach could help us learn applicable lessons from international experiences e.g; demand side considerations for water saving and efficiency in Mexico model; demand driven city planning by factoring climate change and civil society and research community involvement from PlaNYC.
For cities like New Delhi, new models in the water sector need to be explored especially from demand side water management (a clear lacunae in the Delhi Climate Change Agenda). Increase focus on ensuring provisioning of potable water especially for the urban vulnerable.
- *Do not rule out* Public-Private Partnership (PPP) as a strategy of Utility Reform; However this has to be a slow and steady process and 'Rules of the Game' have to be carefully worked out (Dunio, 2000)

Appendix: Consumer Complaints on the Delhi Jal Board Registered Online*

We are making this complaint that we are suffering with scarce city of water in 31 block west patel nagar New Delhi. Met politician , Engineer of Delhi Jal Board also. But no result. Continue 3 days water supply is not there it is regular feature of our block. If Board supply water it is up to 10 minute only. Can any body survive with this. This is really shame on us as a citizen of India. We are income tax payee and other tax are also paid as per the rules. Following all the rules made but sorry to say that Delhi jal Board never think that this is a right of every citizen of india to get water as a fundamentele right. Because of the indisperity of Govt office one persone become helpless and forced to raise voice against the corrupt officer. if they will not resume the continue and smooth supply definetly we will file a case against the currept officer of patel nagar and also make complaint in Sonia darbar to get the justice

<http://www.consumercomplaints.in/complaints/water-not-supplied-c252790.html>, accessed on 17th February, 2010

There is no water supply for the last 25 days in EG Block (Inderpuri) . In spite of repeated complaints and the assurances from the officials of Delhi Jal Board the water supply has not been restored causing undue hardship to the residents of these block who are living on the tail end of the street as any water released is pumped by heavy motors installed by the residents who are living in front row depriving us from getting any water. There are also taps attached to the main pipeline which are always found to be running and lowering the preassure of water which could not reach the exact destination. Kindly look into this and save us from lving a miserable life without water

<http://www.consumercomplaints.in/complaints/no-water-supply-in-eg-block-inderpuri-c175684.html> accessed on 17th February, 2010

* The readers may note that this complaints have directly been taken from the website and there is no attempt from us to correct the spelling and grammatical mistakes of the person making the complaint. The message does come across, without the need for us to do any corrections.